P- 67

Mobile App-Based Rehabilitation for Bedridden Patients After Intensive Care Unit Discharge

Yong Hoe Koo MD[1], Seungwoo Cha MD[1], Ye ji Kim PT[2], Chaelin Lee PT[1], Sanghee Lee MD[3], Jaeho Choi [3], Young-In Yoon MD, PhD[4], Kyung-Wook Jo MD,PhD[5], Youngran Lee RN[6], Won Kim MD,PhD[1] (doucl79@gmail.com)

[1]Department of Rehabilitation Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea
[2]Asan Institute for Life Sciences, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea
[3]EverEx Inc., Seoul, Korea
[4]Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea
[5]Department of Internal Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea
[6]Department of Nursing, Asan Medical Center, Seoul, Republic of Korea

Introduction

- Mobile health applications for post-intensive care unit(ICU) patients with ICU-acquired weakness: scalable solution to early rehabilitation.
- Study Aim: To evaluate the feasibility, safety, and clinical effectiveness of a mobile application(MORA)-based rehabilitation program for bedridden patients after ICU discharge.

Methods

Study Design

- A prospective, single-arm clinical trial
- Adult post-ICU patients with limited ambulatory function (Functional Ambulatory Category [FAC] ≤ 3)
- **Intervention: Individualized exercise program via the MORA digital rehabilitation system**
  - ✓ 2 daily sessions over 2-4 weeks
  - ✓ Stepwise modules targeting specific body part(upper, lower extremity and trunk)
    - √ Step 0: Passive → assisted, low-intensity(e.g range of motion) bed-level activity
    - √ Step 1: Active bed-level strengthening activity
    - √ Step 2: Seated functional & strengthening activity

Clinical data collection

- Functional outcomes(e.g. Medical Research Council Sum Score(MRC-SS), ICU Mobility scale)
- Heart rate reserve(%HRR)
- Compliance(performed/prescribed exercise session)
  - ✓ High (≥ 50%) vs Low (< 50%)

(A)

(B)

Figure 1. Application-guided inpatient rehabilitation using the MORA platform.
(A) A hospitalized patient performing a lower extremity exercise with MORA application & physical therapist's supervision
(B) Screenshot of the MORA application interface demonstrating standardized exercise instructions

Funding

- Supported by a grant from the Korea Health Technology R&D Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health & Welfare, Republic of Korea (No. RS-2024-00408722).

Results

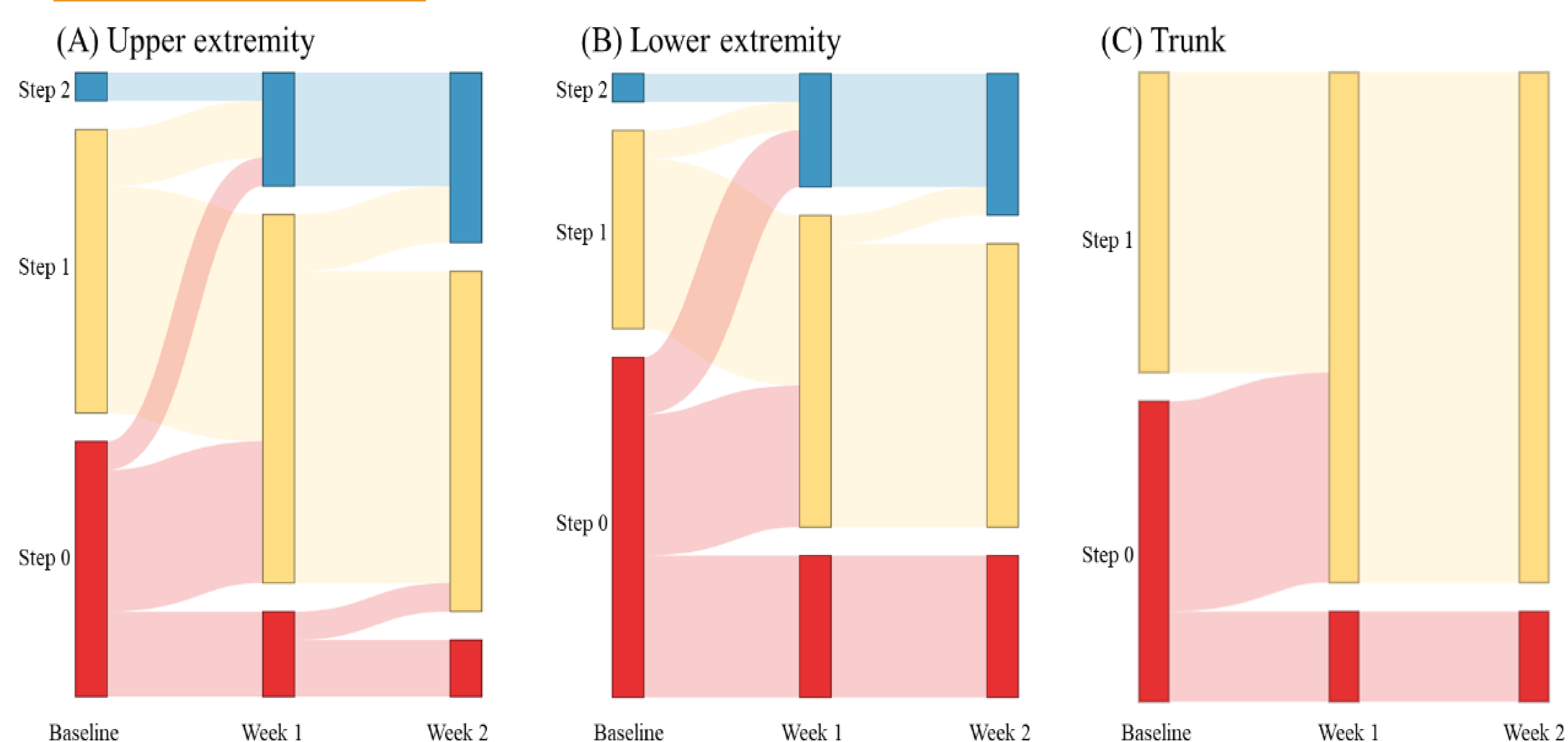

Figure 2. Exercise program progression over time for the (A) upper extremity, (B) lower extremity, and (C) trunk components.

- **Successful Exercise Progression**
  - ✓ Consistent longitudinal increase in both exercise steps and resistance intensities over 2 weeks
  - ✓ Proving MORA as an effective tool to drive progressive rehabilitation

Table1. Changes in functional evaluation, pain, and heart reserve

	Baseline	Week 1	Week 2	P for time	P for compliance	P for time x compliance
MRC-SS	39.0 ± 7.7	42.3 ± 6.1	45.6 ± 5.5	< 0.001	0.055	0.011
ICU mobility scale	6.4 ± 2.5	7.5 ± 2.0	8.4 ± 1.3	< 0.001	0.042	0.181
FAC	1.1 ± 1.0	1.9 ± 1.2	2.2 ± 1.1	< 0.001	0.431	0.161
Bridge test	1.6 ± 1.3	2.0 ± 1.1	2.4 ± 1.0	< 0.001	0.260	0.069
SLR test	1.9 ± 1.2	2.4 ± 1.1	2.7 ± 0.7	< 0.001	0.245	0.024
EQ-VAS	52.7 ± 21.8	66.8 ± 18.2	68.7 ± 18.6	0.002	0.945	0.448
NRS	1.6 ± 2.0	0.6 ± 1.3	0.8 ± 1.2	0.010	0.329	0.734
%HRR	23.3 ± 13.6	23.5 ± 13.7	26.0 ± 16.3	0.590	0.710	0.770

EQ-VAS: the EuroQol Visual Analog Scale, FAC: Functional Ambulatory Category, ICU: Intensive care unit, MMSE: Mini-Mental State Examination, MRC-SS: Medical Research Council-Sum Score, NRS: Numeric Rating Scale, SLR: Straight leg raise.

- **Safety and Tolerability**
  - ✓ Maintained a very light-to-light %HRR (23.3~26.0%) with no serious adverse events
  - ✓ Safe and well-tolerated, suggesting room for safe progression to higher intensities
- **Significant Functional Recovery**
  - ✓ Successfully achieved significant functional and mobility gains alongside the digital program

Conclusion

- **Safe and Feasible Strategy:** The smartphone-based program → highly viable and safe tool to promote early functional recovery in bedridden post-ICU patients
- **Overcoming Resource Barriers:** Bridging the gap of pragmatic problems like staffing shortages → effective adjunct to ensure the continuity of rehabilitation in the general ward